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as minnows and stickle-backs, to fresh water must be done gradually if we wish a happy result; in this process we have an example to follow, set by nature herself, for there are instances of bodies of what were once salt waters, so freshening by degrees that they still retain seals and certain marine animals. We may find crabs in the Charles River at some distance above Cambridge, and they may be kept alive and in health for a length of time in the fresh-water aquarium.

The system of artificial aëration and that of producing an ebb and flow in the marine aquarium have been practiced with success in large collections of aquaria.

The value of the aquarium as a means of instruction cannot be overestimated, affording as it does the opportunity of studying the habits of aquatic animals in a manner attainable by no other means, and giving to all an inducement to pursue further the study of natural history which will be a pleasure throughout life.

A SKETCH OF THE TRUCKEE AND HUMBOLDT VALLEYS.

BY W. W. BAILEY.

Since the opening of the Pacific Railroad all have had their attention more or less turned to that vast region lying between the Sierra Nevada and the Rocky Mountains. It is known as the Great Basin; but if, misled by the name, we conceive merely of a boundless valley, more or less desolate, we shall arrive at a somewhat erroneous conclusion. It is indeed a depression between the two giant ranges of the continent, but traversing this are successive parallel mountain chains with a north and south trend, and only inferior in altitude to the Rocky Mountains and the Sierra. Indeed, according to our eastern notions, the whole so-called basin is but a broad mountain top, as no portion of it is below four thousand feet. Notwithstanding the general sterility of the soil it will be seen, as I proceed, that it sustains quite an extensive and peculiar flora. With the belief that a brief sketch of this unique region will be of interest to naturalists I have ventured to present the results of my observations.

My first botanical rambles were along the banks of the Truckee River, which has its source in Lake Tahoe, a lovely sheet of pure, cold and clear water, situated on the eastern boundary of California. From this Alpine lake the little river flows into the Great Basin and waters some of the best farming lands in Nevada. It is a narrow and rapid stream, mostly shallow, and with a rocky or sandy bottom. At intervals nature has adorned its banks with groves of cottonwood (*Populus monilifera*). It is sincerely to be hoped that these noble trees will be spared by the rapacious wood-choppers, as in a country so meagre in its sylva, a green thing, if it be but a shrub, is cheering to the spirit, and a full-sized tree is a positive delight. The size of these poplars, and the wide spread of their branches, render them especially welcome to the traveller, who, parched and weary, seeks refuge within their shade.

In speaking of the plants of Nevada it is convenient to classify them much as they are distributed in nature, and we find that according to their location they naturally fall into three grand divisions:

1st. The plants of the river bottoms and margins of irrigating canals.

2d. Those found on the desert plains at a distance from water.

3d. Those of the mountains.

These main divisions for ease in study may again be subdivided into sections almost as naturally marked, namely:

A marginal section immediately contiguous to the rivers or lakes.

A meadow tract, moistened generally by artificial irrigation or by streams descending from the mountains, and usually dry in the summer months.

A desert section proper and one more particularly pertaining to the alkaline flats and vicinity of saline springs.

Lastly, the flora of the mountains is naturally divided into two distinct fields, according as the plants grow in the cañons in the vicinity of water, or flourish on the higher and more exposed regions where in the summer months little or no moisture is obtained, unless from an accidental shower, or by direct condensation from the atmosphere. Of course these divisions are more or less arbitrary and shade the one into the other. Following the above order we observe that on the Truckee there are a few plants immediately bordering the river and small streams which have apparently been drifted from above with soil and debris swept off by floods. The original habitat of some of these plants, I presume to be the neighborhood of Lake Tahoe, although no definite data can be given in support of such an opinion without an examination of the flora near the source of the stream. Still, certain plants which I always found on sandy shoals and islands in the Truckee, and nowhere else, lead me to this conclusion. Seeds, too, have undoubtedly been transferred from place to place through the same medium; but whether, with the exceptions just mentioned, the prevalent plants have advanced from the east or the west, I am not prepared to say. It would require for the study more time and larger experience than it was my lot to bestow upon it. The species of plants found along the Truckee at one camp differed but slightly from those discovered at another, preserving a close resemblance to each other as far as Wadsworth, the limit of my investigations. It would be tedious and uninteresting to read a list of the plants found in this region, a more correct account of which will, I hope, soon be given to the public by one more competent to treat of them, and I shall therefore only mention such as are conspicuous to the traveller as he passes by, or such as have a positive or possible industrial value. Among the smaller plants a species of mint is common, and a hemp from which the Pi-Ute Indians make their bow strings. There is also a highly ornamental species of sunflower (*Helianthus*), well worthy of cultivation, as its smaller and more brilliant flowers render it more attractive than the grosser garden form. The Mexican Poppy (*Argemone Mexicana*), is occasionally seen, and a thistle, which I consider unequalled in beauty. The delicately cut leaves look as if formed of silver, and the flower resembles a paint-brush charged with scarlet lake. I have before mentioned the fine groves of cottonwoods, but in addition to these a fringe of willows is often found along the stream, and a mingled thicket of "Buffalo berry" (*Shepherdia argentea*), Roses (*Rosa blanda*), and other shrubbery. The bright berries of the Shepherdia and scarlet lips of the rose present a pleasing appearance, contrasted, as they are, with the silvery leaves of the former plant. When the roses are in bloom the effect must be even more charming.

Near Hunter's Station the river flows through extensive meadows producing abundance of hay and vegetables. The native grasses are mostly grown, but our own well-known "Timothy" (*Phleum pratense*), has been introduced to some extent, and is always much prized. This valley and that of the Carson form decidedly the richest portion of the state. The meadows are bounded by Washoe Peak, an outlying spur of the Sierra, by the Pea-vine mountains (so-called from the frequency with which the lupines or wild peas are met with on its sides), and a range lying to the east on which is situated Virginia City. That town, however, is not visible from the river. Washoe Peak is of very great height, and frequently shows snow upon its summit even in midsummer. It is a splendid mountain in form and color, and is especially admirable when the clouds which droop over its snowy sides, are suffused with California's own golden tints. After leaving this fertile valley, the Truckee enters a narrow gorge between high rocky hills, often beautiful in the colors of their exposed strata and always in the graceful outline of their summits. Upon the higher portions only of these hills grows the juniper (*Juniperus occidentalis*), the chief and best firewood of this region, where fuel is so scarce that during the winter of my sojourn, wood sold as high as thirty dollars in gold in Virginia City. The cottonwoods are also sometimes used for fuel by those residing near the river, together with drift wood brought down from the Sierra. The lower slopes inclining to the stream support only the scraggy sage brush (*Artemisia*). Yet even in this narrow defile the farming lands are excellent, and are occupied and cultivated by thrifty settlers. The Truckee after flowing in a general easterly direction as far as Wadsworth, suddenly bends and following a north-west course empties into Pyramid Lake. This is a sheet of water about thirty-five miles in length and ten or twelve in width at the widest part. There are many small and steep rocky islands in the lake, some of them covered with an arborescent tufa resembling coral in its appearance. One very abrupt, pyramidal island gives its name to the lake which was discovered and partially explored by Fremont. The islands are the temporary home of pelicans and other sea fowl, who frequent them in the breeding season, and share the rocky soil with numerous rattlesnakes and lizards. Near the mouth of the river the land is good though subject to overflows, which while they fertilize the soil for future growth, often jeopardize the present crops. This land is held as a reservation by the Pi-Ute Indians, but even this remnant of their once broad acres is coveted by the neighboring whites. The lake is surrounded by mountains, and the lands removed from the water are of little or no value unless artificially irrigated.

Just before its *embouchure* the Truckee throws off a branch which supplies Winnemucka Lake, parallel to Pyramid, but separated from it by a narrow strip of highlands and mountain ridges. This lake is rarely found on any but the most recent maps and we are led to wonder how it could have been overlooked. The fact that it is increasing in depth while Pyramid is said to be decreasing, seems to indicate that it is of recent origin and occasioned by some accidental deflection of the Truckee from its legitimate course. The fresh water of the river is soon deteriorated by admixture with that of the lake, which like all similar sheets, devoid of outlets, is brackish and unpleasant to the taste. The most showy plants of the Truckee Valley, in addition to those already mentioned, were a gigantic Thelypodium often rising to a height of six feet, two species of Mentzelia (*lævicaulis* and *albicaulis*) a species of Hosackia, and two of Cleome, and Sida. Near the mouth of the river occurs a remarkable deposit of infusorial earth. It is found encased in the calcareous tufa so prevalent in this vicinity. Under this lies the basaltic rock. The "chalk," as it is here called, is one hundred feet in width and forms a perpendicular bluff nearly forty feet in height from the stream, which at this point is very deep. The whole deposit is very free from impurities and upon microscopical examination, by my brother, proved to be composed entirely of fresh-water forms.

From the Truckee to the Humboldt Valley there is about a day's hard riding through deep sands and deserts devoid of water, where only grows a depauperate form of sage brush (*Artemisia*), or the equally dreary grease wood (*Obione*). The hills in sight are of volcanic origin, and are covered with loose and blackened scoriaceous rocks, occasionally encased in tufa. There is not a vestige of a tree, shrub or herb, with the exception of the ashy colored sage or the singular Effedra (*anti-syphilitica*). The first and only object that awakens any interest is the group of hot springs. There are some fifteen or twenty of these presenting different degrees of temperature. One spring indicated 201° Fah., while others were positively cool. The water is beautifully clear, but contains salts in solution which render it unpalatable. It is, when cooled, however, preferable to most of the villainous decoctions of the sixty-three elements, which, in the absence of the genuine article, pass in this region for water. It is often in a state of violent ebullition, and is thrown up in intermittent jets, especially when extraneous substances are introduced. Some of the springs of this region, highly saturated with mineral ingredients, build for themselves a conical chimney, as it were, by the deposition of their dissolved constituents. Coarse and wiry, but verdant grasses spring up around. Sometimes living fish make their abode in these boiling springs, though not found in the particular group in question. I have seen them from similar wells where the surface of the water marked 70°. This statement is consistent with that of other observers in various parts of the world. Carpenter says "we have examples of the compatibility of even the heat of boiling water with the preservation of animal life. Thus in a hot spring at Manilla, which raises the thermometer to 187°, and in another in Barbary, whose usual temperature is 172°, fishes have been seen to flourish. Fishes have been thrown up in very hot water from the crater of a volcano, which from their lively condition, was apparently their natural residence." Various confervæ and animalculæ are known to occur in similar situations, and indeed, were noticed in these identical springs. Carpenter adds, "small caterpillars have been found in hot springs of the temperature of 205°, and small black beetles, which died when placed in cold water, in the hot sulphur baths of Albano." After these quotations I hope no one will charge me with Munchausenism. In apparent extravagance they certainly far surpass my statement.

A few hours after leaving the springs the road begins to descend, and soon a view is obtained of the basin into which both the Humboldt and Carson Rivers enter and "sink," or disappear in the sands. A broad, barren valley is stretched out before us, through which the course of the river is indicated by the fringe of green tules which border it. Occasionally the plain is marked by a tract of white alkaline salts, looking like a snow field as it glistens in the sunlight. The mountains, most fantastic in outline, which border the valley, are enveloped in a gauze-like mist which seems to preclude all further inquiry into the features of the anomalous landscape. There is no live color in the scene. Even the greens with which nature usually relieves her more rugged details, are here wanting, except in the case of the tules above mentioned. Still there is a strangely fascinating and weird beauty in the view peculiar to these deserts. Here the Humboldt which begun its course far away as a fair young stream, expands into a lake, and becoming disgusted with its vitiated life commits suicide by self-burial. Hence the spot is known as the Sink of the Humboldt. At the sink proper, the water is intensely alkaline and disgusting to the taste, and the atmosphere is filled with noxious vapors and miasms. The legions of mosquitoes which infest the tules are the food of numerous water-fowl, to whom I candidly wish all success in their warfare upon the insects. Among the birds a black swan is said to appear at times, but I did not have the fortune to see one if any such occur. Above the lake the Humboldt is a narrow, sluggish and serpentine stream, hardly wider than an eastern creek and totally lacking its vivacity. The water is turbid and unpleasant to the taste. The fish which frequent it are when cooked soft and tasteless. Not a tree adorns the last hundred miles of the stream, low willows and Shepherdia being the nearest approach to arborescent growth. The lofty range of West Humboldt mountains are now in sight, whose highest point, Star Peak, rises to an altitude of nine thousand nine hundred and sixty feet above the sea. From the great height of the range, its direction north and south in conformity with the trend of the other ridges, its frequent water courses giving life and beauty to narrow belts of luxuriant vegetation, and the wide prospect to be obtained from its many commanding points, it affords numerous subjects for consideration. Many deep cañons channel its rugged sides, most of which contain clear water. A strange fact in regard to these streams, is that they run freely, even boisterously, during the night and early morning, and dry up utterly in the lower part of their course toward noon. The power of the sun is such as to totally evaporate the water before it reaches the plains, while the powerful radiation during the night allows the stream to resume its proper dimensions. If a handkerchief be saturated with water at noonday and then flirted in the air, it becomes dry in a moment, thus indicating the wonderful absorptive power of the atmosphere. Rains are so infrequent in summer that it becomes a cause of wonders, not that the rills should fail, but that they should ever flow. Along these little streams willows, aspens (*Populus tremuloides*), Cornus, Shepherdia and elders (*Sambucus*) grow most abundantly, and Clematis with its feathery plumes waves over all. The herbage is peculiarly interesting also, columbines (*Aquilegia formosa*), asters and solidagos, leading us away in spirit to where their beauteous kindred smile upon the New England autumn, while the gilia (*G. pulchella*) and lupines are equally lovely though less familiar. Away from the streams the wild sage only thrives, if so wretched a specimen of vegetable life can be said to flourish. By far the greater mass of the mountains is desert, like the plains they overlook. The great, brown earth waves roll down into the valleys unrelieved by a dash of green, except where some sombre juniper fights its hard battle for life. Variously colored lichens occur on all the rocks, and an occasional tuft of moss on those exposed to the streams, but ferns are nowhere seen. High up on the range is found a luxuriant growth of a species of Ceanothus, and at seven thousand feet or thereabouts, the sage yields to the western juniper (*Juniperus occidentalis*) and mountain mahogany (*Cercocarpus ledifolius*). The latter is a handsome tree, averaging twenty feet in height, with bright glossy leaves, whose revolute margins conceal the brown scurf of their inferior surfaces. Its silvery bark, the strangely plumose fruit and shining leaves render it very conspicuous. As in the case of the manzanita (*Arctostaphylla glauca*) of California, the wood is susceptible of a high polish and is used for many ornamental purposes. This tree and the juniper form the only respectable fuel which the country affords, and the traveller may consider himself especially blessed if he lights upon either when frantically searching for the wherewithal to kindle a blaze. The juniper is the more common tree, and is sometimes twenty or more feet in height. The wood is lighter colored and appears scarcely so compact as our eastern red cedar, which in other respects it closely resembles.

The character of the vegetation is quite different on opposite sides of the same range, many plants being found on one side which are not at all represented on the other. As a rule the eastern exposure is the more fertile. Instances of this peculiar distribution are the little alpine potentilla (*Ivesia Newberryi*) found in chinks and crevices of high exposed granite bluffs on the western side, and a curious moss-like Spiraea (*tomentosa*) only found in somewhat similar locations on the eastern side. A few eastern weeds thrive about the houses in Unionville, and I also found *Ranunculus cymbalaria* at quite an altitude in the cañons. This fact does not speak well for the soil, as this little plant generally favors the sea-shore or neighborhood of saline springs. A wild tobacco (*Nicotiana*) is common, which the Indians called "pah! monh!" pronounced as two interjections, and with much the sound of a person vigorously smoking an obdurate pipe. They informed us that it was formerly much used by their tribe, until superseded by the superior article of the white men. The fleshy roots of a Phelipaea they told me they employed as food in the month of October.

The view from the West Humboldt Mountains is very extensive and remarkable. The atmosphere is so pure in this region that it is possible to see a distance of sixty miles as readily as one could twenty at home. From this great height range beyond range is seen both east and west, and there seems to be no limit to our vision. No positive colors enliven the landscape, giving it the pleasing variety of our eastern scenery, but there are only varying tints of brown in the foreground and light azure in the distance. The remote hills look as if merely outlined in blue. The valleys are dreary wastes, through which the roads may be seen winding. From these clouds of dust often rise a thousand feet into the still air. The dreary monotony of the desert is relieved at this distance by the broad plains of snow-white alkali, which it is well to view afar off. They have no fascination for the unfortunate traveller who inhales their smarting dust, penetrating as it does the eyes, nose and ears, and imparting a nauseous soapy taste to the mouth. These deposits often contain embedded crystals of rock-salt of great beauty.

About sunset is the proper time to really enjoy the weird prospect, for the colors the mountains then assume are most charming. The main masses look as if dusted with gold, while each cañon and ravine is filled with purple shadows. The .delicate tints change rapidly, deepening and blending until finally night drops its curtain on the scene. Still the act is not closed, for the stars twinkle above the serrated outline of the mysterious mountains, or the moonlight transfigures their barren slopes.

When we study each detail of this anomalous scenery in its horrible individuality, it seems unreasonable that the whole should in any way delight us, yet that it is fascinating is most certain. There is a peculiar coloring, or rather tinting, seen nowhere else, and never to be forgotten. I do not mean to say that the land is anything but a desert—a literal "howling" wilderness, nor do I maintain with many of the settlers that earth has no fairer habitations. It is an insult to a forest to call it a wilderness in the above sense, teeming as it is with myriad forms of life and beauty, but here where nothing interrupts the view but bare, treeless mountains, is solitude complete and unbroken. Whatever be the charm, it is yet certain that having gazed once we admire the strange picture ever after.

REVIEWS.

REPORT UPON DEEP SEA DREDGINGS IN THE GULF STREAM.*—This number of the Bulletin sums up the results of the different expeditions, and is also especially valuable for many novel and interesting observations upon geological and zoölogical questions. According to Professor Agassiz, the fauna of the reef, consisting mainly of corals, extends to ten fathoms only. The second zone, "a muddy mass of dead and broken shells, broken corals, and coarse coral sand, is chiefly inhabited by worms, and such shells as by their nature seek soil of this character, with a few small species of living corals, some *Halcyonarians*, and a good many *Algœ*." This extends seaward "from a few miles" off Cape Florida to "twenty miles and more off Cape Sable." "A third region, or zone, beginning at a depth of about fifty or sixty fathoms, and extending to a depth of from two hundred to two hundred and fifty fathoms, constitutes a broad slanting table land, beyond which the sea bottom sinks abruptly into deeper waters. The floor of this zone is rocky; it is, in fact, a limestone conglomerate, a kind of lumachelle, composed entirely of the remains of organized beings, animals now living upon its surface." Algæ are but sparsely represented upon the plateau, and though the animals are abundant, the species are generally of small size and belong to genera either identical or closely allied to those of the Cretaceous period. The deep sea proper beyond this zone lies upon "a uniform accumulation of thick, adhesive mud, with a variety of worms and such shells as seek muddy bottoms." Professor Agassiz thinks that if the bottom in these depths was rocky, animal life would be "as varied and as numerous comparatively as are the Alpine plants on the very limits of perpetual snow."

With reference to geology, Professor Agassiz says that he infers from the character of the sea bottom that probably none of the layers of stratified rock on the surface of the globe "have been formed in very deep waters," but around the shore lines of the ancient continents, which have been subject only to comparatively slight changes of level after they were once elevated above the primeval ocean.

In the main bearing of this conclusion Professor Agassiz agrees with

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* Bulletin of the Museum of Comparative Zoology. No. 13. Report upon Deep Sea Dredgings in the Gulf Stream during the Third Cruise of the U. S. Steamer Bibb; addressed to Professor B. Peirce, Supt. U. S. Coast Survey. By Louis Agassiz. pp. 363-386. Cambridge, 1869.